

A new record confirms the occurrence of *Aphanius mesopotamicus* Coad, 2009, in southwestern Iran (Actinopterygii: Cyprinodontidae)

Yazdan Keivany^{1*}, Mohammad Sadegh Alavi-Yeganeh² and Jafar Seyfabadi²

¹ Isfahan University of Technology, Faculty of Natural Resources, Department of Fisheries. Isfahan, 84156-83111. Iran.

² Tarbiat Modares University, Faculty of Marine Science, Department of Fisheries. Noor, Iran.

* Corresponding author: E-mail: keivany@cc.iut.ac.ir

ABSTRACT: We report the occurrence of Mesopotamian tooth carp, *Aphanius mesopotamicus* Coad 2009, in a southern branch of the Karkheh River, 10 km west of Hoor-Al-Azim Wetland. This is the first report of successful collection of this species after its first collection in 1978-80 and futile efforts during the last three decades and after its original description based on those old museum specimens.

The Mesopotamian tooth carp, *Aphanius mesopotamicus* Coad, 2009, was described from southern Mesopotamia in Iran and Iraq. The type locality was the Karkheh River, Khuzestan Province, Iran. The description was based on morphological characteristics of museum specimens collected in 1978 from the Karkheh River branch at Abdolkhan, Iran, and early 1980s collection of paratype specimens from Qarmat'Ali, Basrah, 30°34' N, 47°46' E, in Iraq (Coad 2009). Since the first specimen collections, all further attempts to collect specimens in both countries have been unsuccessful during the last three decades.

Construction of the Karkheh Dam, about 60 km upstream of type locality in 2001, which has led to periodical desiccation of the Karkheh River branches, high pollution of the area as the result of the Iran-Iraq war (1980-1988), aquaculture extension and also diverting river water for agricultural purposes are the probable suspects causing the loss of populations of this species in the area.

As a result of our investigation in December 2010, some specimens of *A. mesopotamicus* were found in downstream in the Karkheh River, about 10 km west of Hoor-Al-Azim Wetland, close to Sousangerd city (48°09'48.3"E, 31°32'59.4"N), indicating the presence of this species 40 km west, and about 100 km further toward river downstream, from the type locality (Figures 1 and 2). The collection site, about 37 m above the sea level, had a calm water flow on a sandy bed with banks covered with plants such as hornworts (*Ceratophyllum* sp.), cattails (*Typha* sp.) and reeds (*Phragmites* sp.). The water temperature was 24.4°C, dissolved oxygen 8.8 mg/l at 106% saturation, pH 8.23, EC 2367 µS, and TDS 1181 mg/l during the sampling.

The collection was made as a part of a joint project of the Iran Environmental Protection Organization and Isfahan University of Technology; the collection permission being granted by the former (No. 32/15827). A total of 60 specimens of *A. mesopotamicus* were collected using nylon seine 5 m long × 2 m deep and 2 mm stretched mesh size;

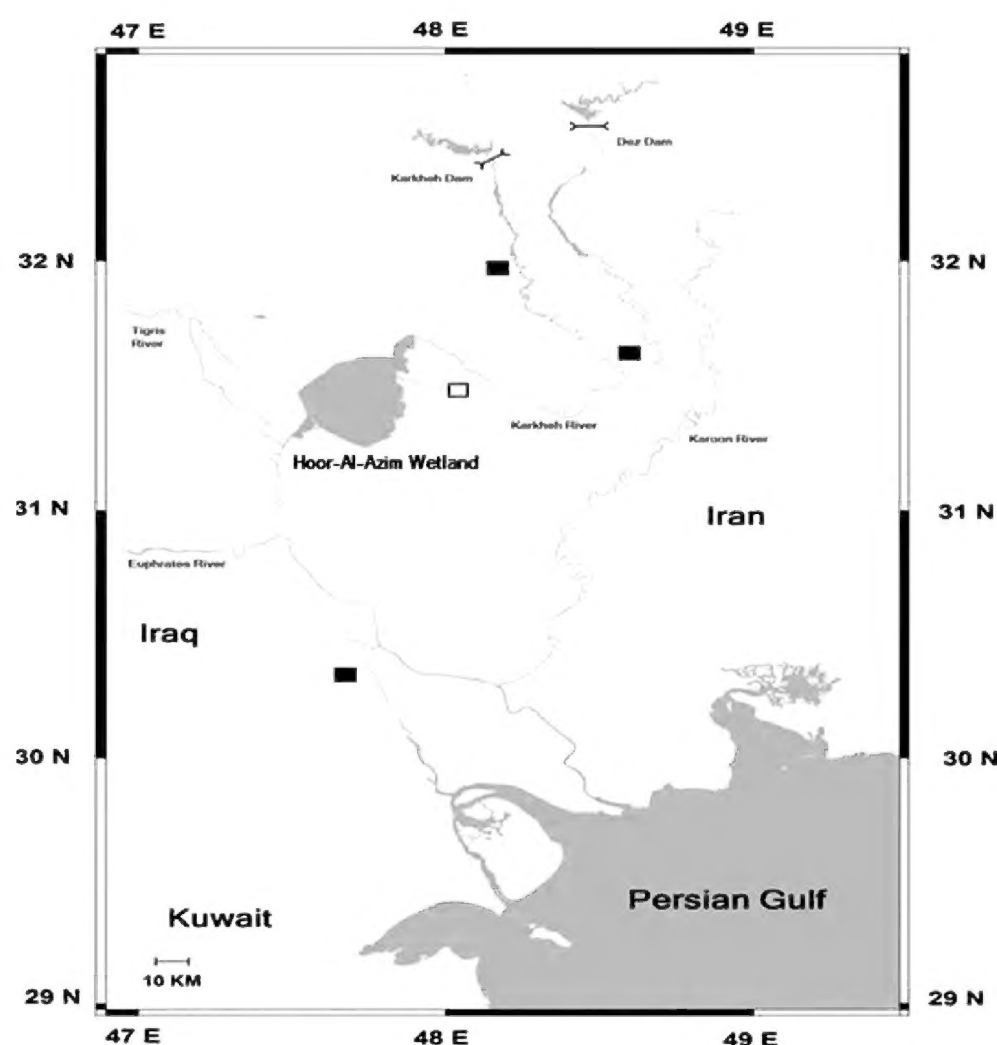


FIGURE 1. Distribution map of *A. mesopotamicus*. Solid squares are previously known localities (in 1978 and early 1980s) and the open square corresponds to the new record locality at 48°09'48.3" E, 31°32'59.4" N, near Hoor-Al-Azim Wetland.

Ten specimens of each sex were used for the morphological study (Figure 3). The specimens were anesthetized with 1% clove oil solution and fixed in 96% ethanol. Collected specimens were catalogued in the fish collection of Isfahan University of Technology (IUT13890807-236-15). Coad (1988; 1996) procedures were followed for counts and measurements. All measurements were taken point to point by a pointer caliper to an accuracy of 0.02 mm. Vertebral counting was done after a bone staining procedure (Dingerkus and Uhler 1977). The morphological findings in our study (Table 1) correspond with those of Coad (2009).

Other species coexist with *A. mesopotamicus* include *Acanthobrama marmid* Heckel, 1843, *Alburnus mossulensis* Heckel, 1843, *Cyprinion kais* (Heckel, 1843), *Carasobarbus luteus* (Heckel, 1843), *Luciobarbus barbulus* Heckel, 1849, *Luciobarbus pectoralis* (Heckel, 1843), *Mesopotamichthys sharpeyi* (Günther, 1874) and *Liza abu* (Heckel, 1843), and also some exotic species such as *Gambusia holbrooki* Girard, 1859 and *Carassius auratus* (Linnaeus, 1758). Mosquito fish, *Gambusia* spp. are strong competitors of

Aphanius spp. (Alcaraz et al. 2008), and this exotic fish could be a serious ecological threat to the Mesopotamian tooth carp in this area.

The description of this species has been based on a series of morphometric and meristic characters in a multivariate analysis along with a color pattern. Molecular techniques and otolith morphometry could add confirmatory data to the current morphological evidences (Hrbek et al. 2006; Reichenbacher et al. 2007).

TABLE 1. Comparison of 12 morphometric and 12 meristic character ranges of 10 female and 10 male specimens of *A. mesopotamicus* collected from Karkheh River with those in Coad (2009).

CHARACTER	STUDY	SEX	RANGE	CHARACTER	STUDY	SEX	RANGE
Dorsal fin rays	Coad 2009	♂	12-13	Standard length/Head length	Coad 2009	♂	3.2-3.6
	This study	♂	11-13		This study	♂	3.5-3.8
	Coad 2009	♀	11-13		Coad 2009	♀	3.3-3.7
	This study	♀	12-13		This study	♀	3.5-3.8
Anal fin rays	Coad 2009	♂	10-12	Standard length/Predorsal length	Coad 2009	♂	1.6-1.7
	This study	♂	11-12		This study	♂	1.6-1.7
	Coad 2009	♀	11-12		Coad 2009	♀	1.5-1.7
	This study	♀	10-12		This study	♀	1.6-1.7
Pectoral fin rays	Coad 2009	♂	13-15	Head length/Head width	Coad 2009	♂	1.5-1.7
	This study	♂	13-14		This study	♂	1.4-1.7
	Coad 2009	♀	14-15		Coad 2009	♀	1.3-1.6
	This study	♀	13-15		This study	♀	1.3-1.5
Lateral series scales	Coad 2009	♂	26-28	Standard length/Preanal length	Coad 2009	♂	1.5-1.7
	This study	♂	25-27		This study	♂	1.6-1.8
	Coad 2009	♀	26-29		Coad 2009	♀	1.4-1.6
	This study	♀	25-27		This study	♀	1.5-1.7
Gill rakers	Coad 2009	♂	10-12	Head length/ Dorsal fin length	Coad 2009	♂	0.8-1.2
	This study	♂	10-12		This study	♂	0.8-1.1
	Coad 2009	♀	11-14		Coad 2009	♀	1.2-1.4
	This study	♀	11-12		This study	♀	1.1-1.4
Caudal peduncle scale	Coad 2009	♂	12-16	Standard length/Head depth	Coad 2009	♂	4.0-4.7
	This study	♂	12-15		This study	♂	4.5-4.8
	Coad 2009	♀	12-16		Coad 2009	♀	4.0-4.7
	This study	♀	12-15		This study	♀	4.2-4.8
Scales between lateral series and dorsal fin	Coad 2009	♂	4-5	Head length/Head depth	Coad 2009	♂	1.1-1.3
	This study	♂	4-5		This study	♂	1.1-1.3
	Coad 2009	♀	4-5		Coad 2009	♀	1.1-1.3
	This study	♀	4-5		This study	♀	1.1-1.3
Scales between lateral series and pelvic fin	Coad 2009	♂	5-7	Head length /Interorbital width	Coad 2009	♂	2.2-2.6
	This study	♂	6		This study	♂	2.1-2.6
	Coad 2009	♀	5-8		Coad 2009	♀	2.3-2.5
	This study	♀	5-6		This study	♀	2.2-2.7
Scales between lateral series and anal fin	Coad 2009	♂	5-7	Head length /Postorbital length	Coad 2009	♂	2.2-2.5
	This study	♂	5		This study	♂	2.1-2.4
	Coad 2009	♀	4-6		Coad 2009	♀	2.1-2.4
	This study	♀	5		This study	♀	2.1-2.4
Precaudal vertebrae	Coad 2009	♂	11-12	Head length/ Pectoral fin length	Coad 2009	♂	1.5-1.8
	This study	♂	11-12		This study	♂	1.4-2.0
	Coad 2009	♀	11-13		Coad 2009	♀	1.5-1.9
	This study	♀	11-12		This study	♀	1.5-2.1
Caudal vertebrae	Coad 2009	♂	15-17	Dorsal fin length/Anal fin length	Coad 2009	♂	1.1-1.4
	This study	♂	16		This study	♂	0.9-1.2
	Coad 2009	♀	14-17		Coad 2009	♀	1.0-1.2
	This study	♀	15-16		This study	♀	1.1-1.3
Flank bars (males)	Coad 2009	♂	10-15	Caudal peduncle length/ Caudal peduncle depth	Coad 2009	♂	1.4-1.8
	This study	♂	10-12		This study	♂	1.5-1.9
					Coad 2009	♀	1.5-1.9
					This study	♀	1.6-2.0



FIGURE 2. Collection site at southern branch of the Karkheh River, Khuzestan Province, Iran.



FIGURE 3. A pair of *A. mesopotamicus* individuals captured in a branch of the Karkheh River near Hoor-Al-Azim Wetland (IUT13890807-236-15).

ACKNOWLEDGMENTS: We are grateful to Mr. Manoochehr Nasri and Mr. Ali Mirzaei for their assistance in field work and Mr. Ken Miller for help with photographs. This study was financially supported by Iran Environmental Protection Organization and Isfahan University of Technology.

LITERATURE CITED

- Alcaraz, C., A. Bisazza and E. Garcia-Berthou. 2008. Salinity mediates the competitive interaction between invasive mosquito fish and an endangered fish. *Oecologia* 155: 205-213.
- Coad, B.W. 1988. *Aphanius vladykovi*, a new species of tooth-carp from the Zagros Mountains of Iran (Osteichthyes: Cyprinodontidae). *Environmental Biology of Fishes* 23(1-2): 115-125.
- Coad, B.W. 1996. Systematics of the tooth-carp genus *Aphanius* Nardo, 1827 (Actinopterygii: Cyprinodontidae) in Fars Province, southern Iran. *Biologia, Bratislava* 51(2): 163-172.
- Coad, B.W. 2009. A new species of tooth-carp, *Aphanius mesopotamicus*, from Iran and Iraq (Actinopterygii, Cyprinodontidae). *Zookeys* 31: 149-163.
- Dingerkus, G. and L.D. Uhler. 1977. Enzyme clearing of alcian blue stained whole small vertebrates for demonstration of cartilage. *Stain Technology* 52(4): 229-232.
- Hrbek, T., Y. Keivany, and B.W. Coad. 2006. New species of *Aphanius* (Teleostei, Cyprinodontidae) from Isfahan Province of Iran and a reanalysis of other Iranian species. *Copeia* 2006(2): 244-255.
- Reichenbacher, B., U. Sienknecht, H. Küchenhoff, and N. Fenske, 2007. Combined otolith morphology and morphometry for assessing taxonomy and diversity in fossil and extant killifish (*Aphanius*, †*Prolebias*). *Journal of Morphology* 268: 898-915.

RECEIVED: December 2011

ACCEPTED: January 2012

PUBLISHED ONLINE: May 2012

EDITORIAL RESPONSIBILITY: Javier A. Maldonado O.